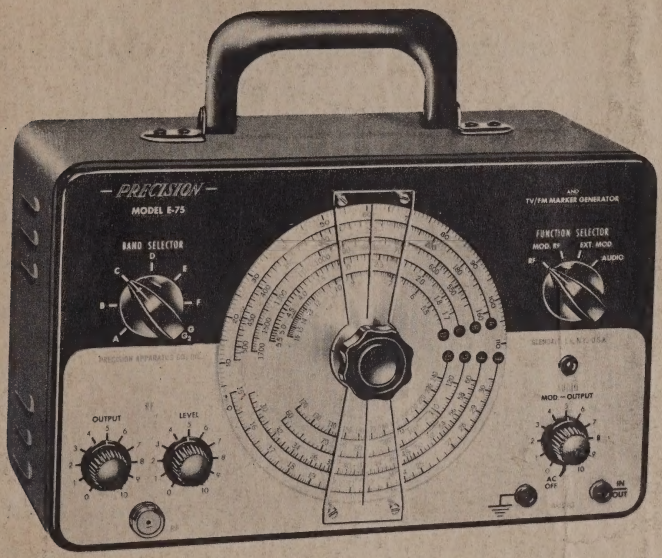
OPERATING INSTRUCTIONS
FOR

PRECISION



MODEL E-75
RF SIGNAL
GENERATOR

PRECISION
TEST INSTRUMENTS BY
PACOTRONICS

PRECISION APPARATUS COMPANY, INC.

70-31 84th STREET • GLENDALE 27, L. I., N. Y.

EXPORT DIVISION: 458 BROADWAY, NEW YORK CITY, U.S.A. CABLES: MORHANEX

CANADIAN SALES DIVISION: ATLAS RADIO CORP., LTD., 560 KING STREET W., TORONTO 2B, ONTARIO

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FEATURES AND SPECIFICATIONS

FREQUENCY RANGE

Band A	160KC to 520KC
Band B	520 to 1700KC
Band C	1.7 to 5.5MC
Band D	5.2 to 16MC
Band E	15MC to 30.5
Band F	29 to 60MC
Band G	60MC to 120MC
Band G_2 (Calibrated Harmonics)	120MC to 240MC

TUBES:

6AU6	Electron coupled RF oscillator
6C4	Audio oscillator and audio amplifier

Power Requirements - 105-125 volts 50-60 cycle AC

Broadcast band is completely calibrated on <u>one</u> band:
Split sound IF range spread wide on Band "E" for accurate TV marking.
Latest 40Mc IF frequency spread out on Band "F" for accurate marking.
FM IF calibrated in .1Mc steps on Band "D" with specific 10.7Mc indication.
TV IF, FM, and other often used frequency points specifically indicated on dial.
0 to 100 linear vernier calibration scale.
RF output in excess of 100,000 microvolts.
400 cycle audio output up to approximately 15 volts.
Percentage modulation continuously variable on front panel.
Two-step low impedance attenuator.

INTRODUCTION

The design of the Precision Model E-75 Signal Generator was predicated upon the need for utmost stability and accuracy of calibration. It is deluxe in every respect and is intended to be used for IF-RF alignment, dynamic signal substitution and troubleshooting in TV, FM and AM servicing, audio testing and experimental work.

In addition, it is ideally suited for use as an accurate Marker Generator for sweep alignment technicians. Highly accurate and stable, the Model E-75 is the ideal generator for the service lab, school and home laboratory.

OPERATING INSTRUCTIONS

The Precision Model E-75 RF Signal Generator has been carefully engineered to meet the various requirements needed to correctly align and test RF, Osc., IF and AUDIO sections as well as FM Discriminator and Ratio Detector circuits. The accuracy and flexibility of this instrument also makes it a valuable aid in TV alignment and troubleshooting.

The following instructions are intended to briefly summarize the most common uses for an RF signal generator. Service literature outlining the alignment procedure of the equipment involved should be used to ensure accurate alignment.

To ensure accuracy and minimize frequency "drift", the generator should be allowed to warm-up for a period of at least 10 minutes. When all component parts have reached their normal operating temperature, the generator will remain very stable.

NOTE: In many instances it will be found necessary to couple the signal generator to a receiver point that has a potential difference with respect to ground. In these cases it is necessary to insert a capacitor in series with the "hot" RF lead to block DC voltages which may damage the attenuation controls or place a low resistance short across the circuit being tested. A capacitor having a rating of .002 mfd at 600V is recommended for this application.

Particular attention should be given to circuits which employ AVC. When making stage gain tests, or during alignment, it may be advisable to disable the AVC and connect a battery or a bias supply unit from ground or B- to AVC buss. The negative terminal of the battery is connected to the AVC buss and the positive to ground. For most work, 1-1/2 volts will suffice. However, some circuits may require higher voltages to prevent oscillation or to lower the gain.

The following alignment practices are typical, and service literature covering the equipment to be aligned should be consulted for generator connections, frequencies and adjustment procedures.

AM RADIO

In the alignment of an AM Superheterodyne radio, there are three sections to be considered and alignment should normally be in this order:

1. IF section, 2. Oscillator section, 3. RF section.

1. IF section - Set the Precision E-75 Signal Generator to the intermediate frequency (IF), place the Function Selector Switch in the MOD. RF position, and connect the RF lead to the grid of the mixer or converter tube. All controls of the receiver under test should be set to maximum. An output meter, or a meter having a low AC voltage range (Precision Model 120), is connected across the output transformer secondary, or speaker voice coil to indicate relative strength of the output. The RF output of the generator should now be adjusted to give a slight reading on the meter.

The IF transformers are then adjusted for maximum meter reading. The last IF should be adjusted first and on back through the set to the first IF. The output of the generator should be kept at the lowest possible level which will give a readable meter deflection.

2. Oscillator section - The RF cable of the Precision E-75 may be left connected to the mixer, or it may be connected to the antenna post, and the ground lead attached to the receiver ground terminal or chassis. (For receivers that use a loop antenna, coupling is best achieved by clipping a single turn loop to the RF cable clips and placing this loop close to the receiver loop antenna.) The generator is set to a specified frequency near the high end of the band and the receiver dial is set to indicate this same frequency. The oscillator adjustments are now made for maximum indication on the meter.

3. RF section - The Precision E-75 RF cable must now be connected to the antenna post, and the ground lead attached to the receiver ground terminal or chassis. (See 2 above - "Oscillator section" - for receivers using a loop antenna.) In general practice, it is good to connect an all-wave dummy antenna between the generator and the receiver. (See Figure 1.)

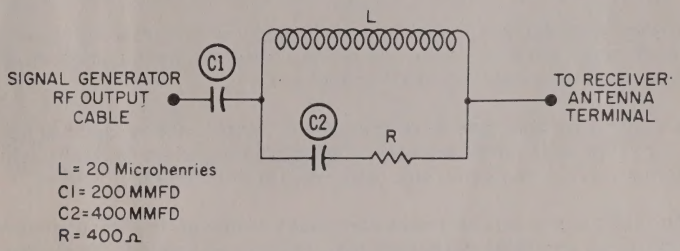

Figure 1

The signal generator is set to a frequency at the high end of the band and the receiver is tuned for maximum output. The RF adjustments should now be set for maximum receiver output as read on the meter being used as output indicator.

The generator should now be set to the low end of the band and the tuning capacitor of the receiver "rocked" through the signal while the RF and oscillator low frequency padders are adjusted for maximum output. In some radios, the only adjustment provided on the low end of the dial is split rotor plates and these may be bent to provide proper adjustment.

FM RADIO

Basically, the IF, RF and Oscillator sections of an FM radio will be aligned in a manner very similar to AM radios. One of the main differences in alignment of an FM set, as compared to AM, is the alignment of the detector circuit. Two basic circuits are used. One combines a limiter tube and a discriminator, and is called a "discriminator detector". The other circuit is called a "ratio detector".

To align a discriminator detector, the Signal Generator is connected to the grid of the limiter tube (V1 in Figure 2), the Function Switch should be placed in the RF (unmodulated) position and the generator is then tuned to the IF frequency specified in the service literature. The generator must remain set at this frequency for all other IF and detector adjustments. A VTVM (Precision Model 48) is then connected across the cathodes of V2 and V3 of Figure 2. The primary of the discriminator transformer is then adjusted for maximum output as indicated by the VTVM. If no indication of peaking is obtained on the meter, the secondary may have to be detuned slightly to obtain a reading. After the primary has been peaked, the secondary is then adjusted for zero voltage reading.

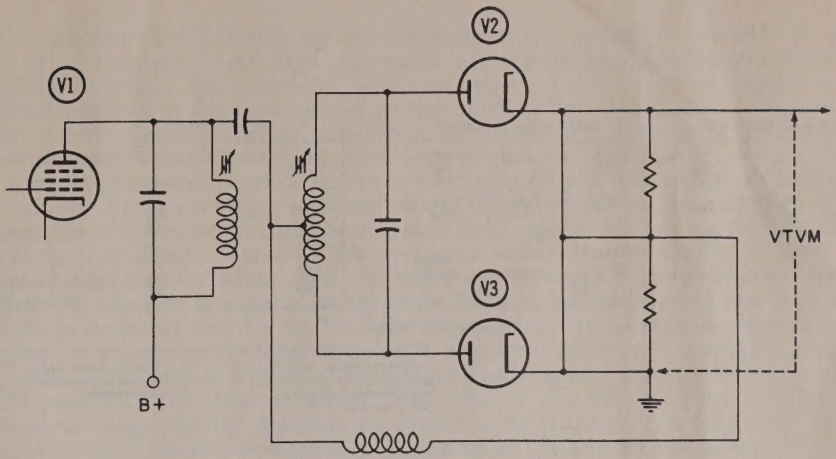

Figure 2

A ratio detector circuit (Figure 3) may be aligned by first connecting a VTVM from point A, across the load resistor (R1) of the ratio detector diode, to ground. The signal generator is then connected to the input grid of the first sound IF stage and set to the IF frequency specified for the receiver being aligned. The primary of the ratio detector transformer can now be adjusted for maximum meter deflection on the VTVM. The frequency setting of the signal generator and the connections of the generator to the receiver remain the same for making the adjustment of the transformer secondary. The VTVM is connected across the output of the detector stage (Figure 3) at Point B and ground. The secondary is then adjusted for zero reading on the VTVM.

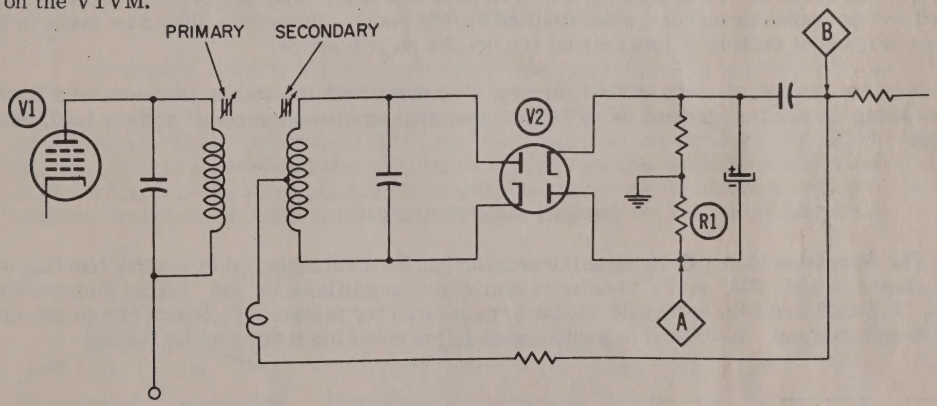

Figure 3

In some cases, special techniques are required when aligning FM discriminators and ratio detectors. The alignment data for the particular receiver being aligned should be consulted.

TELEVISION

The most important use for this Signal Generator in TV service is its application as a Marker Generator when used in conjunction with a Sweep Generator and an Oscilloscope. (See Figure 4.) The instruction manual furnished with a Sweep Generator will cover visual alignment and the use of an AM Signal Generator as a Marker very thoroughly and will not be included in this manual.

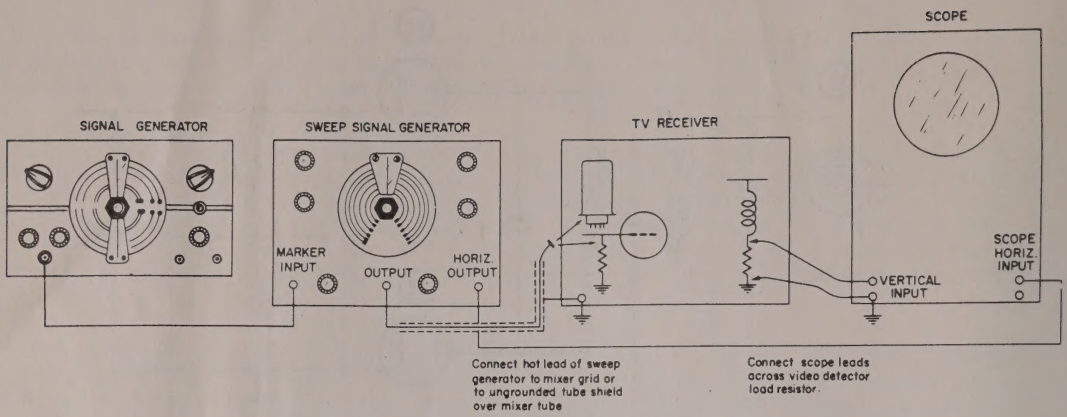

Figure 4

Complete alignment may also be made using only the Signal Generator and a VTVM. The video IF transformers and traps may be aligned by connecting a VTVM, such as the Precision Model 48, across the output of the video detector. The Signal Generator is connected to the input grid of the first video IF amplifier. The alignment procedure specified in the service literature must be followed when making the IF and trap adjustments. In general, RF alignment is made by connecting the Signal Generator to the antenna terminals of the TV receiver, connecting the VTVM across the output of the video detector, and making adjustments according to the service literature.

The sound section of TV receivers operate on frequency modulation (FM) principles. Therefore, the sound IF transformers, sound limiter and discriminator, or ratio detector, are adjusted by the same procedure used to align an FM radio. Reference should be made to the FM radio alignment section of this manual for details on procedure.

It is convenient to make a preliminary alignment with the signal generator and VTVM before making a visual alignment on a TV receiver that has been tampered with or badly misadjusted.

SIGNAL SUBSTITUTION

The Precision Model E-75 Signal Generator can be a valuable aid in rapidly locating defective stages in AM, FM, or TV receivers and audio amplifiers by the "Signal Substitution" method. A Modulated (400 cycle) RF signal is generated for testing RF, Mixer, IF and detector stages by this method. A 400-cycle audio signal is provided for testing audio stages.

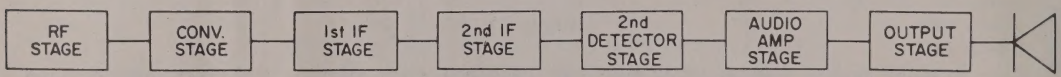

Figure 5

A block diagram of a typical AM radio is shown in Figure 5. To locate a defective stage in this receiver, the appropriate signal from the Signal Generator is injected at the input of each stage, and the output from each following stage is checked until the stage in which the signal is lost or distorted is located. It is usually logical to begin testing at the output stage, then the audio amplifier stage, and continuing back through the receiver towards the RF stage. The output signal can be checked with the speaker, phones, VTVM, or oscilloscope, whichever is most convenient.

The receiver being tested, and the signal generator should be turned "ON" and allowed to warm up. A test lead is placed in each audio jack and the Function Selector Switch is turned to the AUDIO position. The generator will now deliver a 400 CPS audio signal to the AUDIO jacks. The amplitude of this audio signal is controlled by the AUDIO MOD. - OUTPUT control. The volume control of the receiver under test should be fully advanced and the test lead from the black or negative jack connected to the receiver chassis. The lead from the positive or red jack is then clipped to the input of the audio output stage and the generator output control advanced until the 400-cycle signal is heard clearly through the receiver speaker. If a push-pull output stage is to be tested, the test lead should be clipped to the input of one audio output tube and the audio level should be noted. The test lead should then be connected to the grid of the other output tube and the audio level should be the same as in the first test. If no signal is heard from the speaker, in either case, or if the output of the push-pull amplifiers differ greatly, then it may be assumed that the trouble exists in the audio output section. The next step would be to inject the signal into the input of the audio amplifier stage. If this section proves all right, the RF cable is then attached to the generator and the Function Selector Switch is placed in the MOD. RF position. The inner conductor (HOT lead) of the RF cable is connected to the input of the detector stage and the shield is connected to the chassis. The BAND switch is then set to the band covering the IF frequency of the radio under test and the dial is set to this frequency. If this stage is operating satisfactorily, the signal should now be heard from the speaker. Each IF stage may be tested in this manner. First checking the 2nd IF, then the 1st IF. If all tests conducted so far prove satisfactory, the receiver and generator should now be set to the same frequency. The RF output of the generator should now be fed to the input of the mixer stage. This test will show if the mixer section is functioning and also if the local oscillator is operating. The RF output of the generator is now fed to the input of the RF stage of the receiver. For receivers using a loop antenna, coupling is best achieved by using a single turn loop which is clipped to the RF cable of the generator and placed close to the receiver loop. This test is used to check the RF section of the receiver and a good conclusion of the overall performance of the receiver may be taken.

VERNIER SCALE

A vernier scale is placed at the top of the plastic pointer to enable the operator to note the exact position of the dial for any certain frequency. This vernier, or auxiliary scale, should NOT be used to make frequency readings or to sub-divide frequency calibration marks. Its purpose is to enable the operator to find the exact position on the dial for a previously used frequency. This is a convenient feature since the user can make adjustments at a certain frequency, shift the Signal Generator frequency to make other adjustments and then return to the exact dial position necessary to make further adjustments at the previously used frequency.

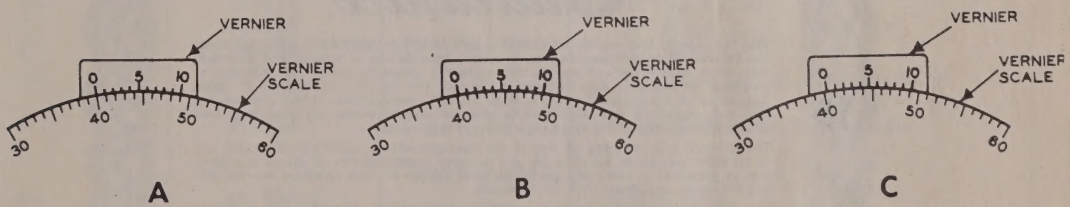

Figure 6

The method of reading a vernier scale is illustrated in Figure 6 and as may be seen, any reading from 40. 1 to 40. 9 may be obtained and this setting may be returned to at any time. The reading on the vernier scale in Figure 6A is 40. Note that the zero on the vernier plate is directly over the 40 on the vernier scale. The reading on the vernier scale in Figure 6B is 40. 1, since the one mark on the vernier plate is directly over a vernier scale division. Figure 6C indicates a reading of 40. 2 because the two mark on the vernier plate is directly over a vernier scale division.

SERVICE POLICY

Precision Apparatus Co., Inc., offers its full cooperation and assistance to help you in obtaining the specified performance from your instrument. We maintain a complete Service Department with whom you may correspond in the event you experience operational difficulties with your instrument or probe. Our in-warranty repair service is available for a period of one (1) year from the date of purchase. Repair service for Precision instruments or probes that have been in use longer, will be available to Precision Instrument owners at economical charges.

SHIPPING INSTRUCTIONS

Instruments for repair or service MUST be returned to us, transportation charges PREPAID, in accordance with the shipping information printed below.

When returning a Precision instrument for repair or service, be sure that all parts are securely mounted. Always pack carefully in a rugged, oversized container, using a generous supply of padding such as excelsior, shredded paper, or crumpled newspaper. NEVER return an instrument unless it is accompanied by a full explanation of difficulties encountered. The more explicit the details, the more rapidly your instrument can be handled, processed, and returned to you.

Please ship PREPAID and address to:

Precision Apparatus Co., Inc.
70-31 - 84th Street
Glendale 27, L. I. N. Y.

Att: Service Department

A FRAGILE label should appear on at least four sides of the carton.

Return shipment to you will be made via Parcel Post COLLECT, including repair-service charges unless otherwise requested by previous correspondence.

Please take note that a Carrier cannot be held liable for damage in transit if, in HIS OPINION, packing is insufficient.

Guarantee
This is to certify that we, the PRECISION APPARATUS COMPANY, INC., guarantee this Instrument, manufactured by us, to be free from defects in material and workmanship under normal use and service. Our obligation under the guarantee is limited to repairing or replacing this instrument through the Service Department, Precision Apparatus Co., Inc., Glendale 27, L. I., N. Y., U. S. A., provided that original purchase has been duly registered and instrument is returned prepaid within one year from date of sale. Registration card is furnished with every instrument.
This guarantee is expressly in lieu of all other guarantees, expressed or implied and of all other obligations on our part, and no other Representative or person is authorized or permitted to make any guarantee or to assume for this Company any liability not strictly in accordance with the foregoing.
This guarantee will not apply to any product which has been tampered with or altered in any way, or which has been subjected to misuse, negligence or accident, or which has the serial number altered, effaced or removed.
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Standard of Accuracy
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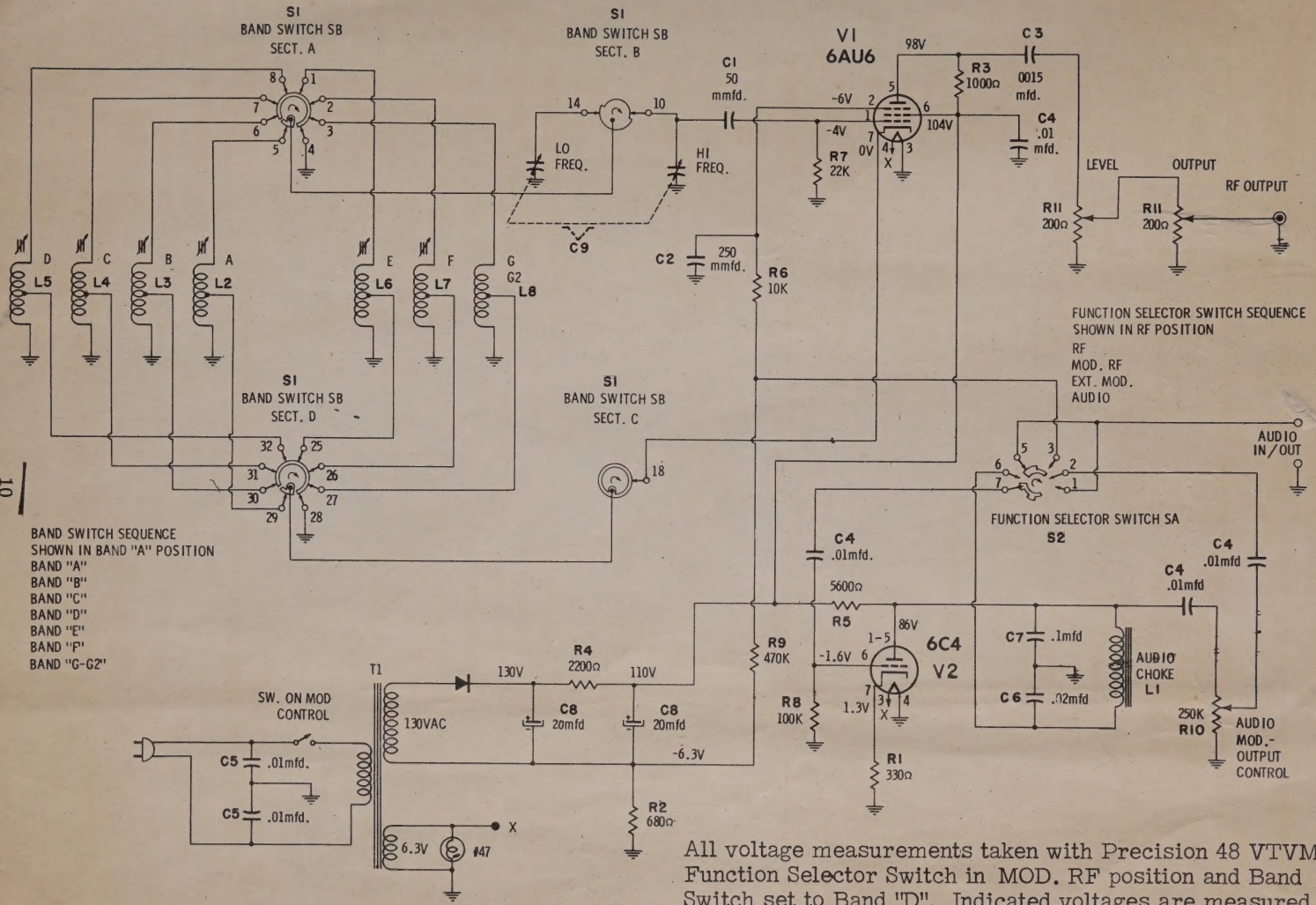
PARTS LIST			
Ref. Symbol	Part No.	Quantity	Description
		RESISTORS	
R1	15-930	1	330 Ohms 10% Carbon
R2	15-897	1	680 Ohms 10% Carbon
R3	15-824	1	1K Ohms 10% Carbon
R4	15-629	1	2200 Ohms 10% Carbon
R5	15-931	1	5600 Ohms 10% Carbon
R6	15-726	1	10K Ohms 10% Carbon
R7	15-793	1	22K Ohms 10% Carbon
R8	15-731	1	100K Ohms 10% Carbon
R9	15-728	1	470K Ohms 10% Carbon
		CAPACITORS	
C1	16-134-1	1	50 mmfd. Ceramic Insulated
C2	16-137-1	1	250 mmfd. Ceramic Insulated
C3	16-146	1	.0015 mfd. Ceramic Disc 1500 mmf.
C4	16-143	4	.01 mfd. Cer. Disc (10,000 mmf.)
C5	16-153	1	.01 mfd. Dual Ceramic Disc Dual 10,000 mmf.
C6	16-159	1	.02 mfd. 400V Tubular
C7	16-103	1	.1 mfd. 400V Tubular
C8	16-232	1	Dual 20 mfd. at 150V electrolytic
C9	16-231	1	Variable Capacitor
		CONTROLS-SWITCHES	
R10	17-219	1	250K Ohm Control w/Sw
R11	17-120D-1	2	200 Ohm Control
S2	14-247	1	Band Switch
S3	14-246	1	Function Switch
		TRANSFORMER-COILS	
T1	18-175	1	Power Transformer
L1	18-173	1	Choke
L2	18-176	1	"A" Band Coil
L3	18-177	1	"B" Band Coil
L4	18-178	1	"C" Band Coil
L5	18-179	1	"D" Band Coil
L6	18-180	1	"E" Band Coil
L7	18-181	1	"F" Band Coil
L8	21-183	1	"G" Band Coil (L shaped heavy wire)
	21-168	3	Special Pre-Cut heavy wire
		TUBE-LAMPS	
V1	19-128-1	1	6AU6 Tube
V2	19-117-1	1	6C4 Tube
	19-125	1	#47 Pilot Lamp
	32-120	1	Selenium Rectifier
		SOCKETS-JACKS-TERMINAL STRIPS	
	20-285	1	Small Pilot Assembly
	35-126	1	Pilot Lamp Jewel
	20-119	2	Alligator Clip
	20-108	1	Cable Connector
	20-109	1	Panel Connector (with ground lug)

PARTS LIST (Continued)			
Ref. Symbol	Part No.	Quantity	Description
	SOCKETS-JACKS-TERMINAL STRIPS (Continued)		
	20-106-2	1	Red Pin Jack
	20-106	1	Black Pin Jack
		KNOBS-FEET	
	10-457	3	Skirted Knob
	10-460-1	2	Pointer Knob
	10-168-1	1	Dial Knob
	29-149	4	Rubber Feet
		SHEET METAL PARTS	
	13-388-11	1	Panel
	13-388-22	1	Overpanel
	13-390	1	Dial & Hub Assembly
	13-391	1	Dial Pointer
	22-170	1	Carrying Case
	11-298	1	Chassis
	23-243	1	Grey Handle
	23-244	2	Handle Hinge



All voltage measurements taken with Precision 48 VTVM, Function Selector Switch in MOD. RF position and Band Switch set to Band "D". Indicated voltages are measured from chassis ground.

Schematic Diagram